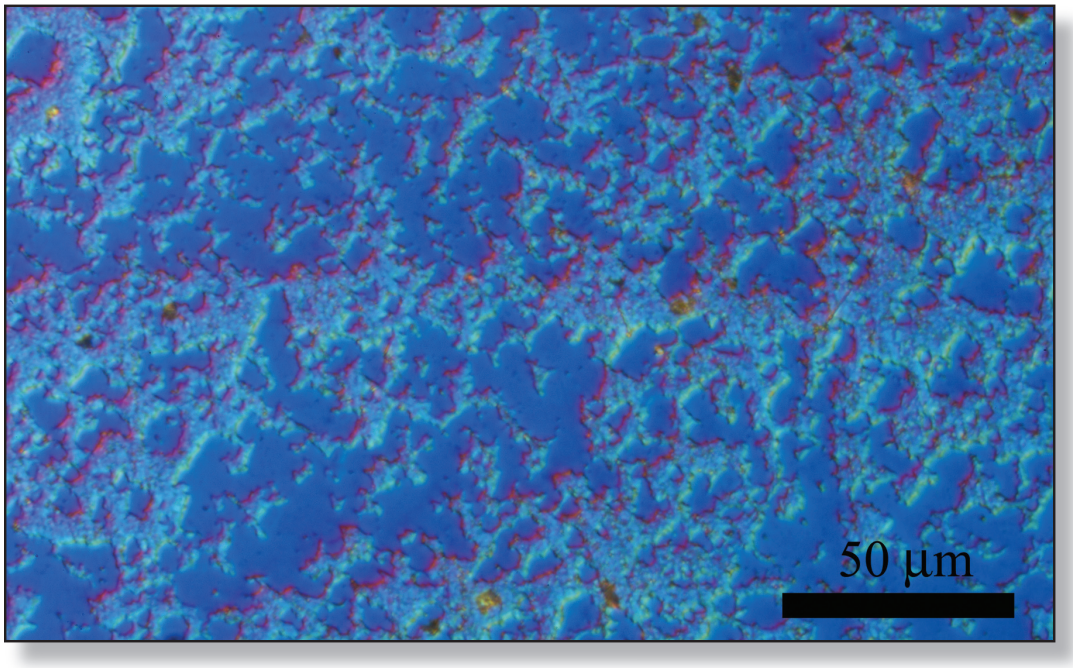
Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

Success Story

BERYLLIUM-ALUMINUM ALLOYS REDUCE WEIGHT OF SPACECRAFT COMPONENTS AND PROVIDE GREATER STIFFNESS THAN CONVENTIONAL MATERIALS



Beryllium-aluminum (Be-Al) alloys help reduce the weight of vital spacecraft components while increasing payload and/or performance. The Materials and Manufacturing Directorate's research program has increased the technology base and demonstrated cost-effective manufacturing capabilities in prototype components derived from a detailed collaborative design process.

These advancements will benefit the space program and national security and could lead to important applications in the commercial sector. Continued research in this promising area will lead to expanded applications and streamlined manufacturing processes, as well as significant cost reductions for the Air Force and Department of Defense.

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Accomplishment

Directorate scientists and engineers, working with industry, demonstrated the feasibility of using Be-Al alloys to fabricate component parts for spacecrafts. The project team succeeded in producing multiples of near-net shape and net-shape parts and in joining subassemblies to make complex structures like those used on spacecraft.

The directorate is engaged in a dynamic research and development effort as part of the Metals Affordability Initiative (MAI), designed to extend the use of Be-Al to both primary and secondary structural space applications. Be-Al alloys being investigated under this program cover a Be content range of 35-65% by weight, with a focus on materials with lower Be contents, to better manage costs. The Be-Al MAI program succeeded in increasing the technology base and established cost-effective manufacturing capabilities for fabricating prototype components.

The project team successfully formulated and demonstrated the worthiness of a detailed collaborative design process and the feasibility of producing near-net-shape and net-shape parts. They joined subassemblies to make complex structures and made significant progress in materials development, component selection and design, and component fabrication and testing. A major accomplishment of this research and development effort was the successful production of multiples of two important structural components.

Background

Be-Al alloys have been used in a number of high-performance applications, such as gas turbine engines, racing cars, space launch vehicles, and satellite structures, due to a unique combination of low density and high stiffness. The specific strength and stiffness characteristics of Be-Al exceed those of traditional titanium alloys. These properties enable reduced structural weight and increased payload and/or performance. Be-Al is also of interest as a replacement for pure Be because it offers much greater stiffness than Al alloys at lower material cost than pure Be and improved formability, enabling fabrication into near-net shapes and further cost reductions.

The project team, overseen by researchers in the directorate's Metals, Ceramics and Nondestructive Evaluation Division, comprises spacecraft original equipment manufacturers (OEMs) and material suppliers. Within the collaboration, OEMs are responsible for design and component validation, and material suppliers have the lead role in developing cost-effective manufacturing technologies.

Materials and Manufacturing
Emerging Technology

Additional information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (04-ML-02)